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WASTE SOURCE STUDY AND REVIEW OF WASTE TREATMENT AND CONTROL PRACTICES, AMERICAN CYANAMID COMPANY, MILTON, FLORIDA

B. H. Adams, et al

Environmental Protection Agency
Athens, Georgia

May 1972

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REPORT TO THE CONFEREES OF THE THIRD SESSION OF THE
CONFERENCE IN THE MATTER OF POLLUTION OF THE
INTERSTATE WATERS OF THE ESCAMBIA RIVER BASIN
(ALABAMA-FLORIDA) AND THE INTRASTATE PORTIONS
OF THE ESCAMBIA BASIN WITHIN THE STATE OF FLORIDA

WASTE SOURCE STUDY
AND
REVIEW OF WASTE TREATMENT AND CONTROL PRACTICES
AMERICAN CYANAMID COMPANY
MILTON, FLORIDA

May, 1972

Environmental Protection Agency
Surveillance and Analysis Division
Athens, Georgia

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The planning and operation of this project was carried out under the supervision of B. H. Adams, Chief, Engineering Services Branch.

Mr. C. A. Sweatt was project engineer. Mr. W. R. Davis was field survey chemist and principal author of this report.

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INTRODUCTION

This report presents an evaluation of waste treatment and waste controls at the American Cyanamid Company's Santa Rosa Plant located near Pensacola, Florida. The report specifically characterizes and quantifies all plant discharges into receiving waters and evaluates current waste treatment and waste control practices. The study, conducted by the Environmental Protection Agency during March 6-12, 1972, was in response to a recommendation of the third session of the Federal-State Enforcement Conference on Escambia Bay.

Appreciation is extended to personnel of the Florida Department of Pollution Control for assistance in making preliminary arrangements and for providing laboratory space, and to American Cyanamid Plant management and personnel for survey assistance.

HISTORY OF PROBLEM

PROBLEM SUMMARY

A water quality survey of the Escambia River and Bay was conducted by the Federal Water Pollution Control Administration[1/] during September-October 1969.(1) The Federal report stated that poor water quality conditions in Escambia Bay and Mulat-Mulatto Bayou were caused by excessive discharges of carbonaceous, nitrogenous, and phosphorous wastes from local industrial sources, including American Cyanamid Company's Santa Rosa Plant. The 1969 report attributed the following waste loads (lbs/day) to American Cyanamid:

		Phosphorus		Nitrogen		
BOD_5	TOC	Total	Ortho	TKN	NH_3-N	NO_2-NO_3-N
4,450	5,230	3.0	2.0	4,160	538	693

FEDERAL-STATE ENFORCEMENT CONFERENCES

The first "Conference in the Matter of Pollution of the Interstate Waters of the Escambia River Basin (Alabama-Florida) and the Intrastate Portions of the Escambia River Basin Within the State of Florida" was held on January 21-22, 1970, at Gulf Breeze, Florida.

The conferees concluded that "the entire upper section of Escambia Bay north of the Louisville and Nashville Railroad Company bridge is in a state of accelerated eutrophication as shown by unstable dissolved oxygen variations resulting from algal activity; high carbon, nitrogen and phosphorus concentrations; and oxygen demanding sludge deposits."(2)

1/ Now the Environmental Protection Agency.

The conferees further concluded that the Louisville and Nashville Railroad bridge inhibited flushing and exchange between the upper and lower bay, thus resulting in sludge deposits that cause water quality degradation. The conferees also concluded that these conditions were the result of waste discharges and circulation problems outlined in the EPA report.

Recommendations of the 1970 conference affecting American Cyanamid were that:

- Industries and municipalities reduce the carbonaceous and nitrogenous wastes by 94 percent and the phosphorus wastes by 90 percent by December 31, 1972.
- American Cyanamid immediately cease discharging acrylonitrile.

The second session of the conference was held in Pensacola during February 23-24, 1971. Previous conference recommendations were modified by imposing effluent limits to augment the previously-established carbon, nitrogen, and phosphorus percent reductions.(3) Load limits established for American Cyanamid were:

- Biochemical Oxygen Demand (BOD_5) - 425 lbs/day
- Total Nitrogen - 323 lbs/day
- Total Phosphorus - not applicable

The conferees recommended that these levels be met by December 31, 1972, and if these levels prove excessive, American Cyanamid must develop a plan for completely removing their discharge from the bay.

The company was also directed to submit, by February 15, 1972, a plan for maximum feasible reductions of carbonaceous material.

The third session of the Federal-State Conference was held in Pensacola during January 24-25, 1972. The conferees expressed dissatisfaction with the inadequacy of American Cyanamid's plans to meet conference recommendations.(4) The conferees maintained the same percentage reductions and effluent waste loads for carbonaceous, nitrogenous and phosphorus materials established at the second session of the conference. The time schedule required submission of plans for maximum reductions of carbonaceous material by February 15, 1972, and reductions to meet conference recommendations by December 31, 1972.

STATE OF FLORIDA ENFORCEMENT ACTIVITIES

In mid-1969, the Florida Pollution Control Board ordered American Cyanamid to provide 90 percent minimum treatment to their wastewater discharges.(5)

During March 1972, American Cyanamid was issued additional orders for corrective action by the Florida Department of Pollution Control. These orders required controls to prevent rainwater overflow of wastes and submission of a report containing a preliminary plan of action for:

- a sound in-plant source-control and wastewater management program that will completely eliminate present discharges of contaminated wastes into Escambia Bay.
- an abatement plan to provide, by January 1, 1973, not less than 90 percent treatment for wastes to be disposed of by

deep well injection (if applicable).

- the elimination of liquid waste discharges, containing contaminants, into Escambia Bay after December 31, 1972.

FINDINGS

1. Wastewater discharges into Escambia Bay from American Cyanamid's Santa Rosa Plant do not presently meet conference-established limits. It is highly unlikely that the company will even come close to meeting conference recommendations by December 31, 1972. Since the 1970 Federal-State Enforcement Conference, the company has apparently made substantial wastewater reduction through source controls and process improvements; however, there have been no improvements in or additions to the treatment facilities, and effluent discharges continue to exceed by more than ten-fold the allowable effluent limits set by the conferees in January 1971. Recommended discharge limits and EPA study findings for the 1969 and 1972 studies are:

Parameter	Recommended Loads (lbs/day)	1969 Study (lbs/day)	1972 Study (lbs/day)
5-day Biochemical Oxygen Demand (BOD_5)	425	4,450	6,390
Total Nitrogen	323	4,850	3,850
Total Phosphorus	Not Applicable	3	6

2. The major contaminants observed in the discharge into Escambia Bay were the nitrogenous and carbonaceous materials. The final effluent, some 10 to 12°C warmer than receiving waters, also contained significant concentrations of total residue (average - 922 mg/1) and thiocyanate (average - 52 mg/1). Trace amounts of metals and

0.51 mg/l of 2,3-dibromo-propanol, an organic compound used as an intermediate in the manufacture of flame retardents, were also detected in the effluent. Nitrogenous and carbonaceous wastes, however, are the pollutants having the most detrimental effect on water quality in the bay.

The discharge contained undetectable levels of acrylonitrile In-plant modifications and increased efficiency of strippers had increased the acrylonitrile removal by more than 99 percent. Presently, 250 pounds per day of acrylonitrile are being landfilled.

3. The two 4-acre lagoon treatment system, designed primarily for the removal of solids, was removing 72 percent of the non-filterable residue, 8 percent of the BOD_5, 37 percent of the total organic carbon (TOC), 34 percent of the chemical oxygen demand (COD), and 22 percent of the total nitrogen.

4. Fiber production during the 1972 study averages approximately 235,000 pounds per day. This represents a 8,000 pounds per day production increase since the 1969 study. Maximum fiber production is projected to increase to 416,000 pounds per day by 1975. At present production levels, it may be possible to meet Federal-State Enforcement Conference Recommendations with secondary biological treatment (including denitrification) and associated in-plant modifications such as recycling of once-through waters, product recovery and process improvements. At projected production levels, additional studies will be needed to determine if conference recommendations can be achieved by treatment techniques.

5. Prior to 1970, no waste source controls were installed specifically for pollution abatement. Since 1970, the removal and recovery of acrylonitrile, sodium thiocyanate and finish has resulted in substantial reductions in TOC, COD and acrylonitrile. Although acrylonitrile has been eliminated from the discharge into Escambia Bay, the TOC load averaged 4,100 pounds per day -- 1,130 pounds per day less than the load in 1969. Approximately 6,000 pounds per day of sodium thiocyanate has been removed from the waste stream. In-plant changes scheduled for completion in 1972 should also substantially reduce the volume of wastewater, the nonfilterable residue and total carbon in the waste streams.

6. American Cyanamid refused to grant EPA permission to conduct inplant sampling which restricted Federal wastewater sampling to lagoon influent and effluent locations. The company did, however, conduct concurrent sampling of the fibers area, reactor area, recovery area, carpet plant, utilities area, and lagoon effluent. In-plant sampling accounted for about 77 percent of the total carbon and 100 percent of the total nitrogen measured by the company in the lagoon influent. The reactor area contributed about 62 percent of the total carbon and 78 percent of the total nitrogen in the lagoon influent.

7. American Cyanamid has drilled a 1,546-foot exploratory well to evaluate the feasibility of subsurface wastewater disposal. Preliminary wastewater management plans include the combined use of biological treatment and deep well disposal to meet effluent

limits established by the State and Federal pollution control agencies. The following data summarize the abatement program and present projected waste loads for 1975.

Parameter	Total Waste Volume-Load (MGD #/D)	Deep Well Volume-Load (MGD #/D)	Biological Treatment Influent (MGD #/D)	Biological Treatment Effluent (MGD #/D)
Flow[1/]	7.3	1.24	4.9	4.9
BOD_5	16,255	14,200	2,055	614
TOC	12,660	11,060	1,600	800
T-N	5,665	4,970	695	490
TKN	3,100	2,420	680	---
Org. N	2,970	2,335	635	---
AN	1,970	1,970	0	0
CN	35	10	25	<1
SCN	2,855	415	2,440	<20

NOTE: The existing EPA policy on the disposal of wastes by subsurface injection states that:

> "The Environmental Protection Agency is opposed to the disposal or storage of wastes by subsurface injection, without strict controls and a clear demonstration that such wastes will not interfere with present or potential use of subsurface water supplies, contaminate interconnected surface waters, or otherwise damage the environment. Controlled subsurface injection may be acceptable where: (1) It has been demonstrated to be the best waste disposal alternative in terms of overall environmental protection. Subsurface injection should be recognized as an essentially temporary solution, subject to development of better alternatives, and is to be minimized in its use for the disposal or storage of wastes wherever possible. (2) It is utilized in connection with overall planned management of groundwater or related resources."

1/ Recycling accounts for the differences in wastewater volumes generated and discharged.

TREATMENT ALTERNATIVES

ALTERNATIVES INVESTIGATED

American Cyanamid has investigated numerous proposals from both the company Engineering and Construction Division, and Black, Crow and Eidsness consulting engineers. These include:

- Ion exchange for thiocyanate recovery.
- Improved acrylonitrile stripper efficiency.
- Extended aeration.
- Aerated lagoon.
- Deep well disposal.
- Removal of DARCO fines from wastewater.
- New process techniques to reduce carbonaceous wastes.
- Water conservation and recycle.

RECOMMENDED ALTERNATIVES

After careful review of the company engineering reports and of literature pertaining to American Cyanamid's wastes, the following are recommended:

- Clean water separation and recycling should be utilized where possible.
- New process techniques should be incorporated when available.
- Additional consideration should be given to ion exchange for thiocyanate recovery.
- With the removal of the DARCO/Hyflo solids, the installation of ion exchange for thiocyanate removal, the recycling of

dilute wastewater streams, and the biological treatability of the wastes, the alternative of deep well disposal should not be seriously considered at this time.

- One of the best available biological treatment alternatives is aerated lagoons with a denitrification process.

DESCRIPTION OF PLANT FACILITIES

GENERAL

The Santa Rosa Plant of the American Cyanamid Company is located in Santa Rosa County, Florida, on the eastern shore of Escambia Bay (Figure 1). The plant area covers approximately 60 acres and includes about 16 manufacturing and support buildings. The plant provides employment for approximately 640 people.

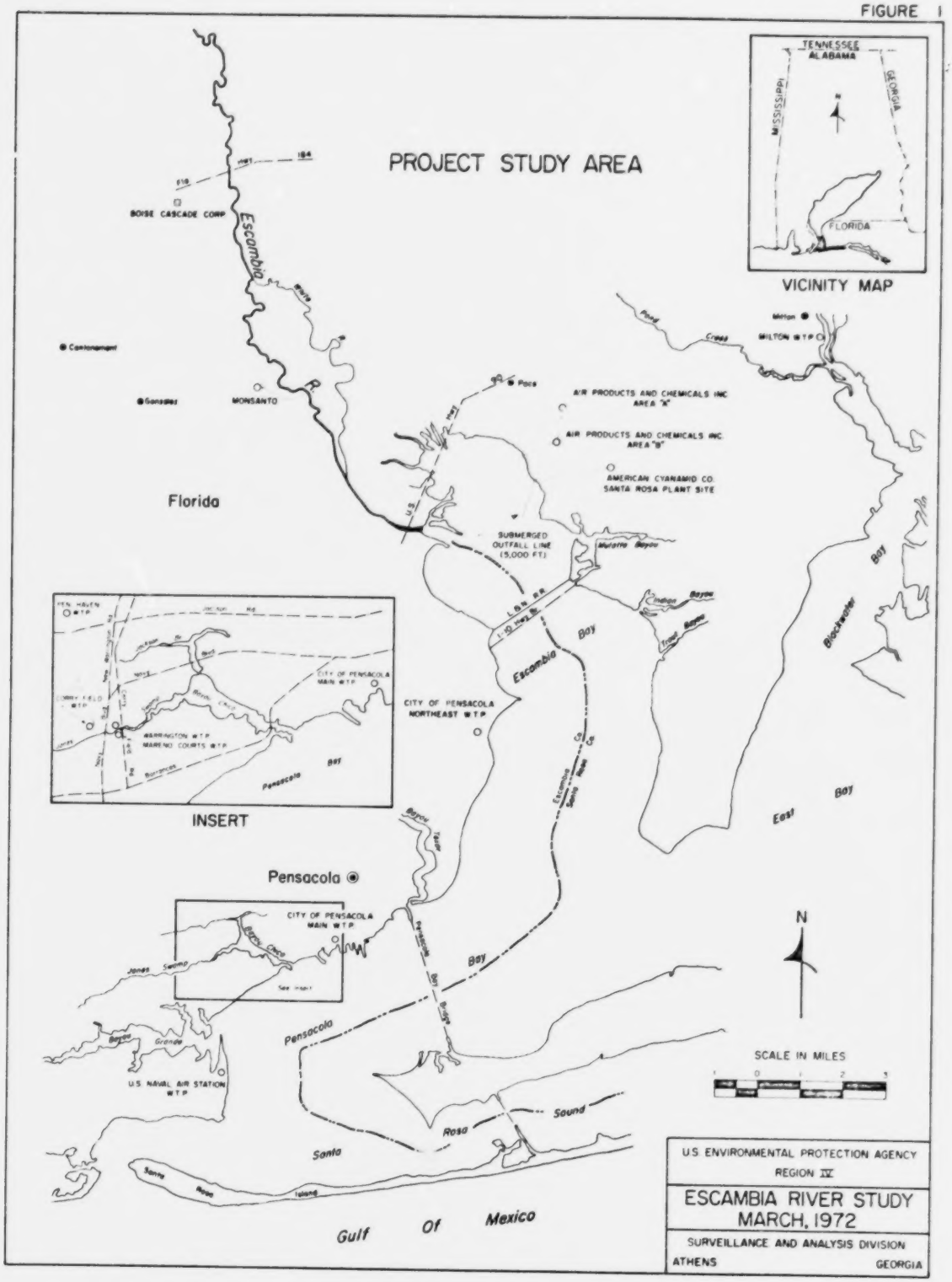
The principal product is acrylic fiber. Since the plant began production in 1958, fiber production has increased to an average of 235,000 pounds per day. Facilities necessary to support maximum production levels of 416,000 pounds per day of fiber have been installed (Appendix D). The company anticipates maximum production in 1975.

The basic chemical manufacturing process is the production of acrylic polymer from acrylonitrile and methyl-methacrylate monomers. The monomers are reacted, washed, stored, and, when needed, dissolved in sodium thiocyanate solvent. The dissolved polymer is passed through spinnerettes which produce continuous fibers. The solvent is removed by countercurrent washing of the fiber with water. Solvent recovery is built into the manufacturing process, and more than 99 percent of the solvent is recovered and reused. The fiber is then subjected to further mechanical processes of crimping, cutting, and baling.

WASTE TREATMENT FACILITIES

The present wastewater treatment facilities at the Santa Rosa Plant include a separate collection systems for storm waters, sanitary sewage

FIGURE 1


PROJECT STUDY AREA
TENNESSEE
ALABAMA
MISSISSIPPI
GEORGIA
FLORIDA
VICINITY MAP
BOISE CASCADE CORP
Escambia
R.
Florida
MONSANTO
Pace
AIR PRODUCTS AND CHEMICALS INC AREA "A"
AIR PRODUCTS AND CHEMICALS INC AREA "B"
AMERICAN CYANAMID CO. SANTA ROSA PLANT SITE
SUBMERGED OUTFALL LINE (5,000 FT.)
MILTON W.T.P.
CITY OF PENSACOLA NORTHEAST W.T.P.
Escambia Bay
Blackwater Bay
East Bay
Pensacola Bay
Pensacola
Gulf Of Mexico
Santa Rosa Sound
Santa Rosa Island
U.S. NAVAL AIR STATION W.T.P.
CITY OF PENSACOLA MAIN W.T.P.
INSERT
N
SCALE IN MILES
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ESCAMBIA RIVER STUDY
MARCH, 1972
SURVEILLANCE AND ANALYSIS DIVISION
ATHENS GEORGIA

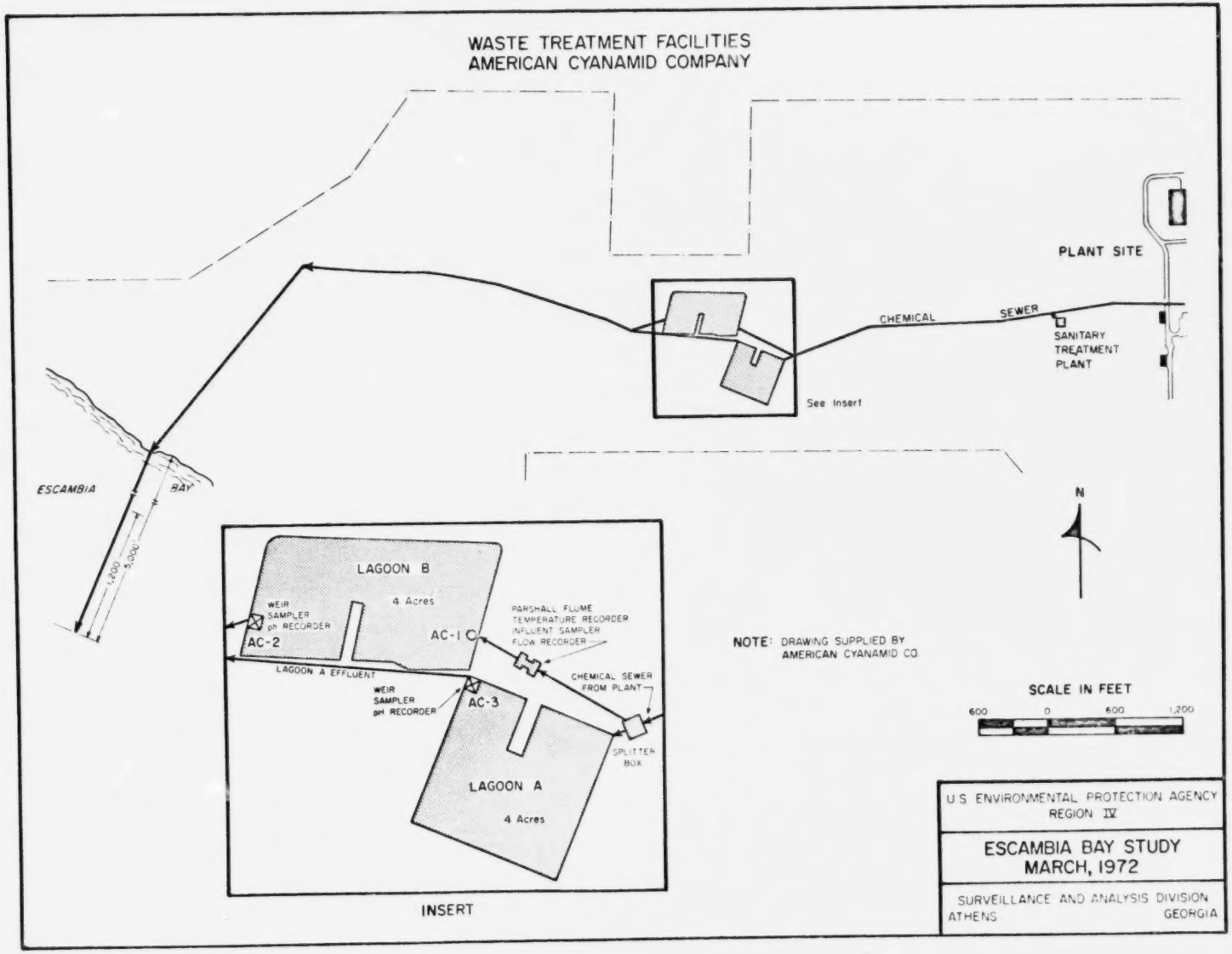
and process wastewaters. Additions to the initial 1958 system were installed in 1966. Plant area storm drainage is diverted into four catch basins, where it percolates into the soil. Sanitary wastes are treated through a primary system consisting of a manual bar screen and two 12-foot by 8-foot Yoeman Brothers "Spirahoff" units, sludge drying beds and chlorination.

The industrial waste facility was originally designed for a flow of 3.5 MGD. The facility, a single-celled lagoon, was designed for solids removal, pH equilization and temperature control. The system was enlarged by the addition of a second lagoon to accommodate a flow of 7.2 MGD.

Combined wastewater (including primary treated sanitary wastes) enter the lagoon system through the chemical sewer; a splitter box divides the flow approximately equally into each lagoon (Figure 2). Each lagoon is about 4 acres in size; however, their capacities have been reduced considerably by the disposition of solids. A baffle 90 feet long and stretching to the bottom was being installed in lagoon "A" during the study. Lagoon "B" has a baffle consisting of 4-foot aluminum sheets suspended from a pipe. The baffle system has been added to help regulate pH fluctuations and to minimize short-circuiting of the water.

The inlet into lagoon "B" is equipped with a Parshall flume, flow recorder, temperature recorder, and an automatic sampling device. The outlets from both lagoons have an automatic pH recorder, temperature recorder, an automatic sampler and a stainless steel screen for large solids removal. Flow is measured by correlating the flow entering

FIGURE 2


WASTE TREATMENT FACILITIES
AMERICAN CYANAMID COMPANY
PLANT SITE
CHEMICAL SEWER
SANITARY TREATMENT PLANT
See Insert
ESCAMBIA BAY
1,200
5,000
N
LAGOON B
4 Acres
WEIR SAMPLER pH RECORDER
AC-2
AC-1
PARSHALL FLUME TEMPERATURE RECORDER INFLUENT SAMPLER FLOW RECORDER
LAGOON A EFFLUENT
WEIR SAMPLER pH RECORDER
AC-3
CHEMICAL SEWER FROM PLANT
SPLITTER BOX
LAGOON A
4 Acres
INSERT
NOTE: DRAWING SUPPLIED BY AMERICAN CYANAMID CO.
SCALE IN FEET
600 0 600 1,200
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ESCAMBIA BAY STUDY
MARCH, 1972
SURVEILLANCE AND ANALYSIS DIVISION
ATHENS GEORGIA

lagoon "A" to that recorded at the influent of lagoon "B". The total flow is measured by diverting all the flow into lagoon "B"; then splitting the flow to both lagoons and measuring the flow at lagoon "B". The difference is the flow into lagoon "A".

AMERICAN CYANAMID WASTEWATER STUDIES

DISCUSSION OF PREVIOUS STUDY RESULTS

American Cyanamid initiated wastewater studies at the Santa Rosa Plant in August 1969 by employing Black, Crow and Eidsness, Inc., as consulting engineers. The firm's initial study, conducted during September 1969, showed that existing treatment facilities were removing 37 percent of the COD, 7.8 percent of the thiocyanate, and 86 percent of the suspended solids.(6) The firm recommended that the following four-phase program be initiated to evaluate the treatment problem and develop a realistic solution to this problem:

Phase I ---- Wastewater characterization.

Phase II --- Evaluation of methods for reduction, treatment, and disposal.

Phase III -- Pilot plant studies.

Phase IV --- Design, engineering construction and startup.

Phases I, II, and III of the proposed studies have been completed.

The wastewater characterization studies were conducted in December 1969 and reported to the company in April 1970.(6)

Phase II studies were completed in October 1970. This study indicated that the best overall removal of waste constituents could be achieved by a combination of the following treatment processes:

- Source control
- Subsurface disposal
- Recovery of thiocyanate by ion exchange
- Biological treatment

Bench-scale pilot plant studies were initiated in March 1971 on the following biological treatment methods:

- Extended aeration
- Aerated lagoon

Studies also included wastewater recharacterization and deep well disposal. Study results indicated that 90 to 95 percent of the BOD_5 designated for biological treatment could be removed by either of these methods and that effluent BOD_5 loads would range from 450 to 850 pounds per day. Total nitrogen removals by these methods were nil. Concentrated waste streams containing acrylonitrile from some process areas were designated for deep well disposal.

Prior to 1970, numerous in-plant improvements were made to improve the recovery of raw materials such as acrylonitrile and sodium thiocyanate. These improvements resulted in a 75 percent reduction in the loss of sodium thiocyanate for each pound of polymer produced (Appendix D). No waste source controls were installed specifically for pollution abatement prior to 1970. Since January 1970, wastewater reductions have resulted from the following source controls and process improvements:

- Removal of acrylonitrile-contaminated water from the chemical sewer has reduced the AN, COD, and TOC by 1,089, 22,630, and 1,569 pounds per day, respectively;
- Increased efficiency of strippers has resulted in more than a 99 percent removal of acrylonitrile and an additional reduction of approximately 700 pounds per day;
- Removal and recovery of sodium thiocyanate from the

chemical sewer has resulted in the removal of approximately 6,000 pounds per day, and

- Finish material removal from the chemical sewer has reduced total carbon by approximately 500 pounds per day.

Planned in-plant changes and their estimated effect on the pollution abatement program are:

- Removal of DARCO/Hyflo solids -- 70 percent reduction in suspended solids (operational date, September 1972);
- Clean water separation and recycle -- 20 percent reduction in flow (operational date, fourth quarter 1972), and
- New process for polymer production -- 3,000 pounds per day total carbon reduction (operational date, fourth quarter 1972).

WASTEWATER MANAGEMENT PLAN

Although average daily fiber production at the Santa Rosa Plant is presently 235,000 pounds, production is planned to increase from the present maximum daily level of 264,000 pounds to a maximum daily level of 416,000 pounds in 1975 (Appendix D). Virtually all facilities needed to support the 1975 levels of production have been installed at the plant.

Treatment facilities will be designed to handle 1975 projected waste loads. Waste loads generated or discharged to treatment facilities at the present base and projected levels of fiber production are:

Parameter	Production Rate 235,000 lbs/day[1] (Mar. 7-12, 1972) Actual (lbs/day)	Production Rate 264,000 lbs/day[2] (Jan. 1970) Average (lbs/day)	Maximum (lbs/day)	Production Rate 416,000 lbs/day[2] (1975) Average (lbs/day)	Maximum (lbs/day)
COD	23,446	65,520	111,825	103,000	175,000
BOD	8,146	--	--	--	--
Total Carbon	4,703	7,718	12,757	12,200	20,000
TKN	2,249	2,898	6,804	4,560	10,650
NH_3-N	128	189	378	298	595
NO_2-NO_3-N	610	1,985	2,678	3,120	4,210
Total N	2,859	4,883	9,482	7,680	14,860

The following wastewater management plan is proposed for the 1975 wastewater projections[3] at the Santa Rosa Plant.

Parameter	Total Waste Volume-Load (MGD-#/Day)	Deep Well Volume-Load (MGD-#/Day)	Biological Treatment Influent (MGD-#/Day)	Effluent (MGD-#/Day)
Flow[4]	7.3	1.24	4.9	4.9
BOD_5	16,255	14,200	2,055	614
TOC	12,660	11,060	1,600	800
T-N	5,665	4,970	695	490
TKN	3,100	2,420	680	---
Org. N	2,970	2,335	635	---
AN	1,970	1,970	0	0
CN	35	10	25	<1
SCN	2,855	415	2,440	<20

1/ Waste loads with source control reductions.

2/ Waste loads without source control implementation.

3/ Information presented to EPA representatives at a company briefing of pollution abatement on February 24, 1972.

4/ Differences in wastewater volumes are due to recycling.

DISCUSSION OF STUDY RESULTS

STUDY PROGRAM

Initially, study objectives were to characterize and quantify all plant wastewater discharged into receiving waters; evaluate current waste treatment and waste control practices, and propose alternatives for best available treatment technology for waste abatement. However, company officials objected to in-plant sampling by EPA and Federal wastewater sampling was restricted to lagoon influent and effluent locations. Although the company conducted sampling of the fibers area, reactor area, recovery area, carpet plant, utilities area and lagoon influent concurrently with the EPA sampling period, in-plant information was not sufficient to permit a detailed evaluation of waste treatment and control practices and hampered the successful completion of study objectives.

To obtain data representative of normal plant operation, sampling conducted by EPA started on March 7, 1972, and continued for five consecutive days. Samples were collected from the following designated locations:

- AC-1 -- Influent to Lagoon "B"
- AC-2 -- Effluent from Lagoon "B"
- AC-3 -- Effluent from Lagoon "A"
- AC-4 -- Source wells (5)

Twenty-four hourly composite samples were collected by the use of automatic samplers at Stations AC-1, AC-2, and AC-3. These samples were analyzed for BOD_5, TOC, COD, nitrogen series (TKN, NH_3, NO_2-NO_3),

total phosphorus, residue (total, dissolved, nonfilterable, non-filterable volatile, volatile dissolved) acidity and alkalinity. Grab samples were also collected at these locations and analyzed for phenols, oil and grease, cyanide and thiocyanate. Daily composite samples collected at Stations AC-2 and AC-3 were composited over five days for organic and metal analysis. Composite samples of water supply wells (Station AC-4) were collected twice during the survey and analyzed for the previously-listed parameters except for BOD_5, cyanide, phenolics and oil and grease. All samples were split with the company for quality control purposes.

Daily analysis for BOD_5, alkalinity and acidity were performed by EPA field personnel located at the Gulf Breeze Laboratory of the Florida Department of Pollution Control. All other analyses were performed at the Region IV, SAD Laboratory in Athens, Georgia. Samples were air shipped daily to Athens.

DISCUSSION OF ANALYTICAL DIFFERENCES

There was considerable difference in some of the parameters analyzed by the EPA and American Cyanamid laboratories. The greatest differences were in the nitrite-nitrate (NO_2-NO_3) analysis. Generally, EPA nitrite-nitrate results were about 4 to 5 times higher than company results. Although the laboratories used different analytical methods (EPA used the automated cadmium reduction method while American Cyanamid used the zinc reduction method), the different procedures would not account for the differences recorded. An investigation into the cause for the analytical

difference revealed that both laboratories experienced difficulties in analyzing this parameter.

DISCUSSION OF AMERICAN CYANAMID SAMPLING RESULTS

In-plant sampling conducted by American Cyanamid was primarily to show the contributions of carbon and nitrogen from process areas. Results of the 5 days of sampling are shown in Table I and presented in Figure 3.

The sampling locations accounted for all of the total nitrogen waste loads generated and about 77 percent of the total carbon discharging into the lagoon system. Approximately 62 percent of the total carbon and 78 percent of the total nitrogen in the lagoon influent comes from the reactor area. The carpet plant and utilities areas are minor contributors of carbon and nitrogen to the treatment system.

DISCUSSION OF EPA WASTE SAMPLING RESULTS

A comparison of study results with results from the 1969 EPA study show very little progress in reducing the waste load discharged into Escambia Bay (Table II). Although American Cyanamid has apparently made substantial reductions through source control and process improvements since 1969, there have been no improvements in or additions to the treatment facilities, and effluent discharges continue to exceed by a factor greater than ten the allowable effluent limits established at the January 1971 session of the Federal-State Enforcement Conference. To some degree, production increases have minimized the results of pollution abatement efforts. Fiber production, averaging about 235,000 pounds per day during the study period, has increased by 8,000 pounds per day since

TABLE I

PROCESS SOURCE CARBON AND NITROGEN DATA

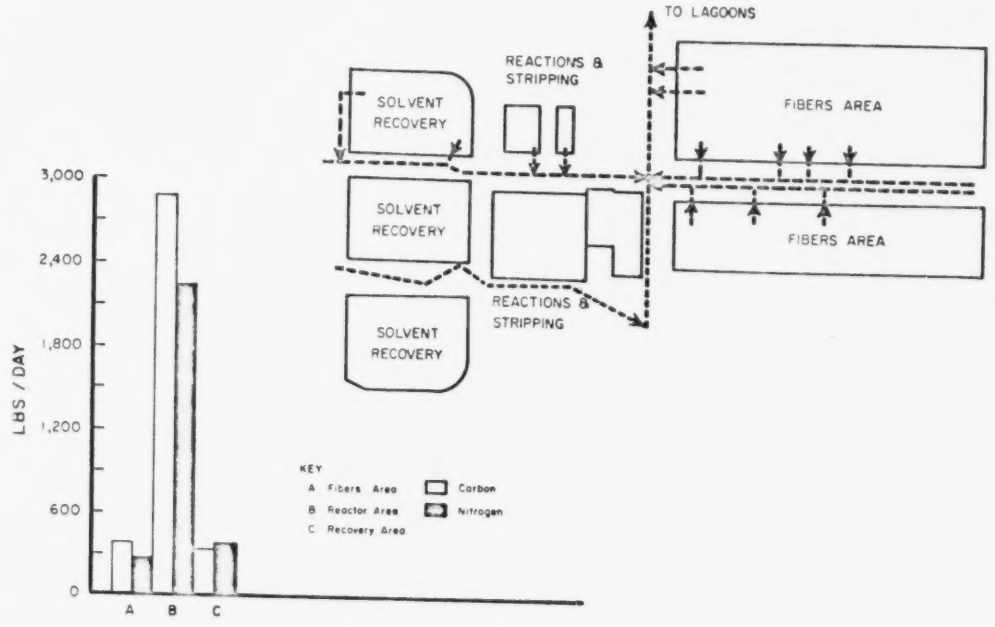
Data Collected by Company March 7-11, 1972

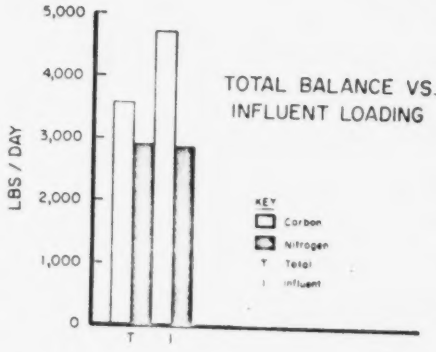
Parameter	Date	Fibers Area Conc. (mg/l)	Fibers Area Load (#/Day)	Reactor Area Conc. (mg/l)	Reactor Area Load (#/Day)	Recovery Area Conc. (mg/l)	Recovery Area Load (#/Day)	Carpet Plant Conc.	Carpet Plant (#/Day)	Utilities Area Conc.	Utilities Area (#/Day)	Total (#/Day)	Lagoon Influent Conc. (mg/l)	Lagoon Influent (#/Day)
Flow MGD	3/7	1.971[1]		0.455[2]		1.258[3]							5.440	
	3/8	1.971		0.455		1.258							5.537	
	3/9	1.971		0.476		1.241							5.342	
	3/10	1.925		0.475		1.102							5.292	
	3/11	1.971		0.494		1.133		0.00359[2]	0.191[1]				5.184	
AVERAGE		1.9595		0.475		1.184							5.359	
Total Carbon	3/7												113	5,127
	3/8	21	345	760	2,883	41	430					3,658	105	4,849
	3/9	23	378	780	3,100	33	342					3,820	100	4,455
	3/10	19	305	790	3,130	28	257					3,692	105	4,634
	3/11	33	542	600	2,471	30	283	38	1.14	20	32	3,296	103	4,453
AVERAGE		24	393	733	2,896	33	328					3,617	105	4,704
Tot. Nitrogen	3/7												74.1	3,362
	3/8	13.5	222	521.3	1,978	50.7	532					2,732	60.3	2,785
	3/9	15.0	247	558.5	2,219	37.0	383					2,849	56.6	2,522
	3/10	12.0	193	735.2	2,913	31.1	286					3,392	63.2	2,789
	3/11	24.1	396	433.3	1,785	39.1	369	2.9	0.09	12.3	20	2,550	65.7	2,841
AVERAGE		16.2	265	562.1	2,224	39.5	393					2,881	64.0	2,860

(1) Based on prior characterization June 1971.
(2) Flow measured on input side of process 100%.
(3) Flow measured on input side 75%, remainder based on June 1971 characterization.

FIGURE 3

CARBON & NITROGEN WASTE SUMMARY
AMERICAN CYANAMID COMPANY





NOTE Data Provided by American Cyanamid Company Collected Concurrent with E.P.A. Study March 7-11, 1972

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV

ESCAMBIA BAY STUDY
MARCH, 1972

SURVEILLANCE AND ANALYSIS DIVISION
ATHENS GEORGIA

TABLE II

COMPARISON OF CONFERENCE RECOMMENDATIONS
WITH 1969 AND 1972 STUDY RESULTS

Parameter	Recommended Loads (lbs/day)	1969 Study (lbs/day)	1972 Study (lbs/day)
5-Day Biochemical Oxygen Demand (BOD_5)	425	4,450	5,300
Total Organic Carbon (TOC)		5,230	4,100
Total Kjeldahl Nitrogen (TKN)		4,160	2,480
Ammonia Nitrogen (NH_3-N)		540	720
Nitrate-Nitrite Nitrogen (NO_2-NO_3-N)		690	1,370
Total Nitrogen	323	4,850	3,850
Total Phosphorus	Not Applicable	3	6

the 1969 study. Influent and effluent loadings shown in Table III indicates the ineffectiveness of existing treatment facilities.

Acrylonitrile has been removed from the wastewater system and is presently being landfilled at a rate of 250 pounds per day. Study results revealed undetectable levels of acrylonitrile in the effluent. The acrylonitrile being landfilled was not observed and the success of this method of disposal is unknown.

The daily plant discharge contained 6,390 pounds of BOD_5 -- 1,940 pounds per day greater than the load measured during the 1969 study. One explanation for the increase in the BOD_5 is the removal of acrylonitrile from the waste stream. Acrylonitrile is inhibitory to the BOD test and the removal of this material has provided more reliable BOD_5 data. There was insufficient dissolved oxygen depletion for positive results in 2 of the 5 BOD_5 determinations. Although the average influent BOD_5 of 153 mg/l was 29 mg/l lower than company results, there was reasonably good agreement with effluent concentrations. Effluent BOD_5 concentrations are assumed to be representative of average values since they agree with monthly values reported by the company to the FDPC between October 1971 and February 1972 (Table IV).

The BOD_5 removal efficiency of the ponds was very low. Lagoon "A" was only removing about 5 percent of the influent BOD_5, while reductions in lagoon "B" were about 10 percent. Although solids had been removed from lagoon "A" in early 1969, a considerable amount of deposition has taken place which drastically affected retention time in the lagoon and consequently affected BOD_5 removal. Solids are scheduled to be removed from

TABLE III

AVERAGE WASTE WATER ANALYTICAL DATA
**** AMERICAN CYANIMID COMPANY ****
MARCH 7-14, 1972

STATION	FLOW RATE GPM	T-ACDITY CACO3 MG/L	T-ALK CACO3 MG/L	BOD 5-DAY MG/L	COD H-LEV MG/L	TOC C MG/L	PHOS-T P-WET MG/L	RESDUE V-NFLT MG/L	RESDUE T-NFLT MG/L	RESDUE TOTAL MG/L	RESDUE T-VOL MG/L	T-KJEL N MG/L	AMONIA NH3-N MG/L	NO2NO3 N MG/L	RESDUE DIS-105 C MG/L
AC-1	1917	13	14	153.3	514	143.6	0.116	51	82	1064	368	52.4	6.16	57.0	982
AC-2	1917	17	139	138.2	319	88.0	0.136	16	23	904	178	54.4	17.00	25.0	881
AC-3	1838	13	113	145.0	355	93.8	0.136	17	23	941	201	55.2	15.00	36.0	899
AC-4	--	6	1	--	5	--	--	--	--	33	12	0.6	0.15	0.3	33

	RESDUE VOL FLT MG/L	TEMP CENT	PH SU	PH LAB SU	CYANIDE CN MG/L	THIOCYAN SCN MG/L	PHENOLS UG/L	OIL GRSE TOTAL MG/L
AC-1	317	41.6	7.3	6.8	0.26	34.1	139	4.0
AC-2	163	25.6	7.4	7.3	0.22	51.4	21	2.3
AC-3	184	27.1	7.5	7.4	0.19	53.0	16	1.6
AC-4	12	--	--	5.0	--	--	--	--

AVERAGE WASTE WATER LOADS DATA

	FLOW RATE GPM	T-ACDITY CACO3 LB/D	T-ALK CACO3 LB/D	BOD 5-DAY LB/D	COD H-LEV LB/D	TOC C LB/D	PHOS-T P-WET LB/D	RESDUE V-NFLT LB/D	RESDUE T-NFLT LB/D	RESDUE TOTAL LB/D	RESDUE T-VOL LB/D	T-KJEL N LB/D	AMONIA NH3-N LB/D	NO2NO3 N LB/D	RESDUE DIS-105 C LB/D	RESDUE VOL-FLT LB/D
AC-1	1917	313	324	3550	11839	3319	2.65	1173	1890	24508	8472	1207.0	145.3	1310	22618	7298
AC-2	1917	384	3200	3234	7358	2027	3.12	364	518	20846	4132	1255.9	391.5	579	20328	3768
AC-3	1838	283	2505	3211	7840	2071	3.00	380	499	20793	4444	1219.4	331.7	795	19849	4065
**	1838	287	309	3384	11346	3179	2.65	1126	1810	23487	8123	1156.7	136.0	1258	21676	----

** DATA FOR POND A INFLUENT WAS NOT MEASURED BUT CALCULATED BASED ON CONCENTRATIONS MEASUED AT POND B INFLUENT (AC-1) AND FLOW CORRELATION BETWEEN THE TWO POND INFLUENTS (SEE FIG.2).

TABLE IV

MONTHLY AVERAGE EFFLUENT DATA SUBMITTED BY AMERICAN CYANAMID TO FDPC
(OCTOBER 1971 TO FEBRUARY 1972)

Date	Station	MGD Flow	SCN	CA	BOD_5	COD	Solids				AN	TOC	NH_3N	Org N	NO_3-N
							Sus	Total	Diss	Vol					
Oct 71	Eff A	2.1	78	.85	153	228	28	1,071	1,042	314	<2	158	11.9	39.9	12.4
	Eff B	2.1	77	.97	139	200	27	1,029	1,002	273	<2	151	14.4	38.9	5.7
	Total	4.2													
Nov 71	Eff A	2.3	83	1.94	110	171	28	1,075	1,047	302	<2	127	7.4	41.0	14.1
	Eff B	2.3	85	1.96	115	165	29	1,017	988	258	<2	123	11.5	40.0	4.36
	Total	4.6													
Dec 71	Tot Eff	5.0	94	0.5	100	161	36	1,053	1,017	301	<2	106	14.1	42.3	2.46
Jan 72	Tot Eff	4.9	67	1.31	149	372	35	996	961	255	<2	97	7.6	40.8	10.46
Feb 72	Tot Eff	4.9	74	0.59	160	399	23	1,108	1,085	341	<2	117	10.7	54.7	14.4

both lagoons during May 1972; however, it is doubtful that this will significantly affect the BOD_5 removal efficiency of the lagoons.

One of the most significant series of parameters to be examined in relation to water quality in Escambia Bay are those of total Kjeldahl nitrogen (TKN), ammonia nitrogen (NH_3-N) and nitrite-nitrate nitrogen (NO_2-NO_3-N). An average total nitrogen loading of 4,930 pounds per day was measured in the influent with an average of 3,850 pounds per day being discharged into Escambia Bay. The overall reduction was 17 and 27 percent for Lagoon "A" and "B", respectively. The data show a mean total nitrogen reduction of 22 percent. The nitrogen loadings (lbs/day) and removal efficiencies are shown below:

	Lagoon B Influent AC-1	Lagoon A Influent	Total	Lagoon A AC-3 Effluent	Lagoon B AC-2 Effluent	Total	Percent Removal
TKN	1,210	1,160	2,360	1,220	1,260	2,480	-4.8
NH_3-N	145	136	281	332	392	724	-157
NO_2-NO_3-N	1,310	1,260	2,570	795	579	1,370	46
Total N	2,520	2,420	4,930	2,010	1,840	3,850	21

The influent TKN and NO_2-NO_3-N values changed very little from day to day, but ammonia values did vary from a minimum of 1.75 mg/1 to a maximum of 15.0 mg/1, averaging 6.16 mg/1. During the study, ammonia and organic nitrogen averaged very close to those values reported to the FDPC by American Cyanamid, but the nitrate-nitrite values found by EPA were substantially higher than those reported by American Cyanamid (Table III). The nitrogen data reported by American Cyanamid to FDPC and those analyzed by their laboratory on samples divided with EPA showed reasonably good

agreement except for NO_2-NO_3-N, which were some 4 to 5 times lower than those values reported by EPA. This difference amounts to nearly 1,000 pounds per day more nitrogen than is being reported by the company.

Examination of the nitrogen data shows that both lagoons are anaerobic. Since there is an overall mean removal of 46 percent for nitrates and 157 percent increase in ammonia nitrogen, a healthy population of nitrogen-reducing bacteria must be present. The process follows a non-typical denitrification path of nitrates being reduced to nitrites with further reduction to both ammonia and nitrogen gas.

Phosphorus levels found in the effluent wastestreams were low -- both lagoon discharges averaged 0.14 mg/1. The loadings of phosphorus of 3 pounds per day observed during the 1970 EPA study were comparable to the 6 pounds per day loading measured during the 1972 study.

Chemical Oxygen Demand (COD) on a pounds per day basis was averaging 23,200 entering the lagoons and 15,200 leaving the lagoons. The reduction was 31 and 38 percent for lagoons "A" and "B", respectively. The reactor areas of the plant accounts for about 62 percent of the COD. (6) There was close agreement between the COD values reported to the FDPC by American Cyanamid and those found during the study. The COD values were relatively constant during the study.

Daily effluent TOC values fluctuated only slightly from a maximum of 92 mg/1 and a low of 83 mg/1 and averaged 88 mg/1. Influent total organic carbon (TOC) loads averaged 6,500 pounds per day while effluent loads averaged 4,100 pounds per day. The daily discharge contained 1,130 pounds less TOC than the average discharged in 1969. The TOC

removal efficiency is 37 percent. TOC values were slightly lower than those reported by American Cyanamid to the FDPC, but a portion of this difference is due to the the inorganic carbon included in the total carbon (Table IV).

The heated wastewater entering the lagoons was dark. The influent water temperature averaged 41.6°C (106.9F) but was reduced to an average of 25.6°C and 27.1°C in "B" and "A" lagoon effluents, respectively. The effluent temperature is approximately 10 to 12°C warmer than either the surface intake water or other effluents measured during the survey period.

Total residue loads from the production areas were relatively constant with an average of 48,000 pounds per day in the lagoon influent. Treatment facilities, designed primarily for the removal of suspended solids, removed 72 and 68 percent of the nonfilterable fixed and volatile residue, respectively. Only 13 percent of the total residue, of which 96 percent is dissolved, was removed by the lagoons. The daily discharge into Escambia Bay contained 41,600 pounds of total residue, 1,020 pounds of nonfilterable residue and 740 pounds of nonfilterable volatile residue. Table V contains a detailed examination of residue loadings and removal efficiencies.

Cyanide was found in the effluents of both lagoons. There was an increase in the cyanide concentrations in each lagoon. Influent values ranged from a minimum of 0.1 mg/1 to a maximum of 0.5 mg/1, averaging 0.28 mg/1. Effluent concentrations averaged 0.36 and 0.44 mg/1 from lagoons "A" and "B", respectively. Effluent loading, based on grab

TABLE V

Solids Loading and Percentage Removals
(March 1972)

Parameter	AC-1 (#/Day)	AC-X (#/Day)	Total (#/Day)	AC-3 (#/Day)	AC-2 (#/Day)	Total (#/Day)	Percent Removal
Residue Volatile NFLT	1,170	1,130	2,300	380	364	744	67.6
Residue Tot. Volatile	8,470	8,120	16,600	4,440	4,130	8,580	48.3
Residue Volatile Filtered	7,300	7,000	14,300	4,060	3,770	7,830	45.2
Residue Dissolved	22,600	21,700	44,300	19,800	20,300	40,200	9.3
Residue Total NFLT	1,890	1,810	3,700	499	518	1,020	72.5
Residue Total	24,500	23,500	48,000	20,800	20,800	41,600	13.2

sample values and daily average discharges, averaged 18 pounds per day. Lagoon "B" had an increase of 10 pounds per day or a 57 percent increase as compared to "A", which had an increase of 8 pounds per day or a 29 percent increase. The cyanide values observed during the survey were lower than those reported to the FDPC by American Cyanamid (Table III). The cyanide concentrations in the influent were relatively constant. The increase in effluent concentrations was probably due to the cyanide being sorbed and released by the solids in lagoons. Influent thiocyanate concentrations were very erratic, ranging from 16.3 to 94.0 mg/1, with a mean of 34.1 mg/1. Thiocyanate influent loadings averaged 1,540 pounds per day, with effluent loadings averaging 2,350 pounds per day. The increase in thiocyanates noted in the effluent is probably due to the variability of concentrations entering the lagoons and/or the solids holding and releasing thiocyanate to the system. The values reported to the FDPC by American Cyanamid over the six months prior to the EPA study showed good agreement with the 1972 study values.

A scan of a five-day composite sample from the lagoon effluents (Stations AC-2 and AC-3) was made to determine the presence of metals. Significant concentrations of metals detected by the scan were verified by atomic absorption methods. Only trace amounts of a few metals were observed (Appendix C). The most significant metal in the discharge was 3.0 pounds per day of chromium.

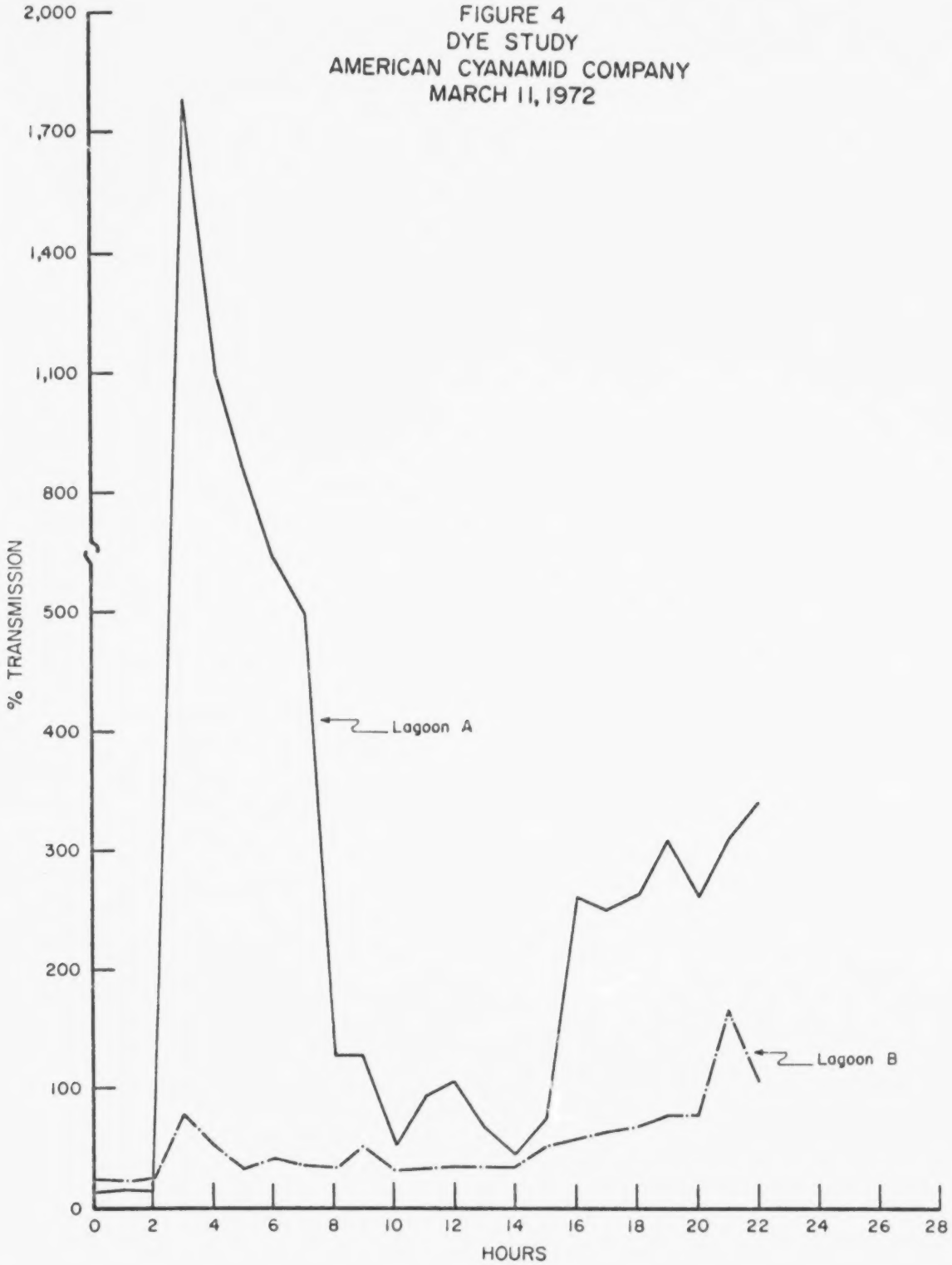
An organic scan, using a gas chromatograph-mass spectrometer system, was made on methylene chloride extracted sampled from effluent sampling stations AC-2 and AC-3. The only compound found with a sizable

peak was 2,3-dibromo-propanol. This compound, an intermediate in the manufacture of flame retardants, was detected in the sample from Station AC-2 at a concentration of 0.51 mg/l. The environmental effects, if any, of this compound are unknown.

In conjunction with the wastewater analyses, samples were collected from the company's five wells and composited. Analyses of this water shows that the source water is of high quality and uncontaminated.

A dye study was performed to help determine the degree of short circuiting through both lagoons. The results show that Lagoon "A" has a greatly-reduced retention time with poor mixing. The peak of the dye started through the effluent after two hours and dropped off after three hours (Figure 4). Lagoon "B" was stable with good mixing and peaked after 21 hours. These results verified reports from company personnel that they had experienced problems with Lagoon "A" in controlling pH due to poor mixing and short circuiting.

FIGURE 4
DYE STUDY
AMERICAN CYANAMID COMPANY
MARCH 11, 1972



REFERENCES

1. Effects of Pollution on Water Quality Escambia River and Bay, Florida -- 1970, Federal Water Pollution Control Administration, U. S. Department of the Interior.

2. Conclusions and Recommendations of the Federal-State Enforcement Conference on Pollution of Escambia River and Bay, Florida-Alabama, First Session, January 21-22, 1970.

3. Conclusions and Recommendations of the Federal-State Enforcement Conference on Pollution of Escambia River and Bay, Florida-Alabama, Second Session, February 23-24, 1971.

4. Conclusions and Recommendations of the Federal-State Enforcement Conference on Pollution of Escambia River and Bay, Florida-Alabama, Third Session, January 24-25, 1972.

5. Bureau of Enforcement Year-End Status Report, December 31, 1971, State of Florida, Department of Pollution Control.

6. Confidential Reports to American Cyanamid Company by Black, Crow and Eidsness, Engineers.

APPENDICES

APPENDIX A

ACKNOWLEDGMENT AND PROJECT PERSONNEL

ACKNOWLEDGMENT AND PROJECT PERSONNEL

ACKNOWLEDGMENT

Appreciation is expressed to Mr. Phil Doherty and his staff at the Florida Department of Pollution Control for providing laboratory space and assisting in sample collection. Company reports provided by the FDPC were very useful in obtaining background information on previous pollution abatement activities. Company assistance and cooperation are gratefully appreciated. Particular acknowledgments are due to Mr. K. N. Sharitz for assistance during sampling.

PROJECT PERSONNEL

EPA Personnel:

Charles Sweatt - Sanitary Engineer

William R. Davis - Field Survey Chemist

Tom Bennett - Chemist

Pat Lawless - Chemist

Wiley Johnson - Laboratory Technician

Jerry Burger - Technician

FDPC Personnel:

Ron Breeding - Technician

APPENDIX B

ANALYTICAL METHODOLOGY

ANALYTICAL METHODS

All chemical analysis will be done in accordance with those methods listed in Methods for Chemical Analysis of Water and Wastes 1971.

1. Acidity - Listed on page 5, uses a NaOH titration to an end-point of pH 8.3. Results are reported as mg/1 $CaCO_3$.
2. Alkalinity - Listed in Standard Methods for the Examination of Water and Wastewater, 13th Edition, p. 52, Method 102 (1971).
3. Biochemical Oxygen Demand (BOD_5) - Standard Methods for the Examination of Water and Wastewater, 13th Edition, p. 489, Method 219 (1971).
4. Chemical Oxygen Demand - Standard Methods for the Examination of Water and Wastewater, 13th Edition, p. 495, Method 220 (1971).
5. Cyanide - EPA Methods for Chemical Analysis of Water and Wastes 1971, p. 42.
6. Metals - EPA Methods for Chemical Analysis of Water and Wastes 1971, p. 83.
7. Nitrogen-Ammonia - (Automated Method) EPA Methods for Chemical Analysis of Water and Wastes 1971, p. 141.
8. Nitrogen - Total Kjeldahl - (Automated Phenolate Method) EPA Methods of Chemical Analysis of Water and Wastes 1971, p. 157.
9. Nitrogen, Nitrate-Nitrite - (Automated Cadmium Reduction Method) EPA Methods for Chemical Analysis of Water and Wastes 1971, p. 175.
10. Oil and Grease - Hexane Extraction - EPA Methods of Chemical Analysis of Water and Wastes 1971, p. 217.

11. Total Organic Carbon - Carbonaceous Analyzer - EPA Methods of Chemical Analysis of Water and Wastes 1971, p. 221.

12. Phenolics - (Automated 4-AAP Method with Distillation) Standard Methods for the Examination of Water and Wastewater, 13th Edition, pp. 501-510, Method 222 through 222E (1971), Modified for Automation.

13. Phosphorus - (Automated Single Reagent Method) EPA Methods of Chemical Analysis of Water and Wastes 1971, p. 246.

14. Solids, Filterable (Dissolved) - EPA Methods of Chemical Analysis of Water and Wastes 1971, p. 275.

15. Solids, Total - EPA Methods of Chemical Analysis of Water and Wastes 1971, p. 280.

16. Solids, Non-Filterable (Suspended) - By difference between total and filterable solids.

17. Solids, Volatile - EPA Methods for Chemical Analysis of Water and Wastes 1971, p. 282.

PROCEDURE FOR ORGANIC ANALYSES

Samples collected from Stations AC-2 and AC-3 were approximately neutral pH when received. They were extracted with 15% methylene chloride in hexane, made strongly basic with KOH and re-extracted with 15% methylene chloride in hexane, acidified with sulfuric acid and extracted for the third time with methylene chloride. The samples were dried by passing through glass wool and then concentrated to 1 ml in a Kuderna-Danish concentrator. The acid extract was esterified using diazomethane. All extracts were injected into a gas chromatograph equipped with a flame ionization detector. The column was glass 6'x2.5 mm I.D. packed with 3% SE-30 on Chromosorb W, HP. The oven was programmed from 75°-240° @ 10°/min. Any peaks detected were subjected to further analysis with the Finnigan GC/MS Model 1015 system. The compounds listed were confirmed by injecting a known standard into the GC/MS. Quantitation was done on the gas chromatograph.

All samples were extracted in duplicate and the concentrations found represent the average of the duplicates. Concentrations found should be considered minimum concentrations as the percent recovery of each compound from water is unknown.

METHODS OF CHEMICAL ANALYSES

Water and Wastewater

PARAMETER	METHOD	REFERENCE	MODIFICATION
Acidity	Volumetric, NaOH Titration	1	Potentiometric Endpoint
Alkalinity	" H_2SO_4 Titration	1	" "
Ammonia	Automated Phenolate Method	2	None
Biochemical Oxygen Demand	Winkler D.O., 5-day	1,2	Azide Modification Formula "C" Dilution Water w/Sewage Sed.
Chemical Oxygen Demand	Acid-Dichromate Oxidation	2	None
Chromium, Total	Atomic Absorption	1,2	$HCl-HNO_3$ Digestion
Cobalt	Atomic Absorption	1,2	$HCl-HNO_3$ Digestion
Copper	Atomic Absorption	1,2	$HCl-HNO_3$ Digestion
Dissolved Solids	Difference Between Total and Suspended Solids	-	-
Cyanides	Pyridine-Pyrazolone	1,2,4	Distillation Cleanup
Manganese	Atomic Absorption	1,2	$HCl-HNO_3$ Digestion
Nitrate-Nitrite	Copper-Cadmium Reduction, Automated	2	None
Oil and Grease	Solvent Extraction	1	None

PARAMETER	METHOD	REFERENCE	MODIFICATION
pH	Electrometric	1	None
Phenols	4-Aminoantipyrine	1	Distillation, Automated Colorimetric Analysis
Phosphorus	Ascorbic Acid Method	2	Automated, Manual Digestion
Suspended Solids	Gravimetric	1	None
Thiocyanates	Ferric Nitrate Complex	3	-
Total Kjeldahl Nitrogen	Automated Phenolate Method	2	None
Total Organic Carbon	Carbon Analyzer	2	None
Total Solids	Gravimetric, 105°C	1	None
Turbidity	Hellige Turbidimeter	2	None
Volatile Suspended Solids	Gravimetric, 550°C	1	None
Volatile Total Solids	Gravimetric, 550°C	1	None
Zinc	Atomic Absorption	1,2	$HCl-HNO_3$ Digestion
Titanium	Atomic Absorption	1,2	$HCl-HNO_3$ Digestion
Vanadium	Atomic Absorption	1,2	$HCl-HNO_3$ Digestion

References

1. Standard Methods for Examination of Water and Wastewater, 13th Edition, 1971.
2. EPA Manual of Methods for Chemical Analyses of Water and Wastes, 1971.
3. Colorimetric Methods of Analysis, Vol. 11A, 1959, Snell and Snell.
4. ASTM Book of Standards, Part 23, 1971.

APPENDIX C

ANALYTICAL DATA

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

AMERICAN CYANIMID COMPANY FIELD STUDY

PARAMETER	DESCRIPTION
00058	FLOW RATE (GALLONS PER MINUTE)
00435	ACIDITY, TOTAL (MG/L AS CACO3)
00410	ALKALINITY, TOTAL (MG/L AS CACO3)
00310	BIOCHEMICAL OXYGEN DEMAND (MG/L, 5 DAY - 20DEG C)
00340	CHEMICAL OXYGEN DEMAND, .25N K2CR207 (MG/L)
00680	CARBON, TOTAL ORGANIC (MG/L AS C)
00665	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)
00535	RESIDUE, VOLATILE NONFILTRABLE (MG/L)
00403	PH (STANDARD UNITS) LAB
00530	RESIDUE, TOTAL NONFILTRABLE (MG/L)
00500	RESIDUE, TOTAL (MG/L)
00505	RESIDUE, TOTAL VOLATILE (MG/L)
00625	NITROGEN, KJELDAHL, TOTAL, (MG/L AS N)
00610	NITROGEN, AMMONIA, TOTAL (MG/L AS N)
00515	RESIDUE, TOTAL FILTRABLE (DRIED AT 105C), MG/L
00520	RESIDUE, VOLATILE FILTRABLE (MG/L)
00630	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)
32730	PHENOLS (UG/L)
00550	OIL-GREASE, TOTAL (MG/L)
00730	THIOCYANATE (MG/L AS SCN)
00720	CYANIDE (MG/L AS CN)
00010	TEMPERATURE, WATER (DEGREES CENTIGRADE)
00400	PH (STANDARD UNITS)
00059	FLOW RATE, INSTANTANEOUS (GALLONS PER MINUTE)
00095	CONDUCTIVITY (MICROMHOS AT 25 DEG C)

AGENCY PRIMARY STATION	SECONDARY	SECONDARY	STATION LOCATION	STATE	MINOR BASIN
1113S000					
641070	AC-01	F-113-43	ESCAMBIA R. AMERICAN CYANIMID CO	FLORIDA	ESCAMBIA RIVER
641072	AC-02	F-113-44	ESCAMBIA R. AMERICAN CYANIMID CO	FLORIDA	ESCAMBIA RIVER
641074	AC-03	F-113-45	ESCAMBIA R. AMERICAN CYANIMID CO	FLORIDA	ESCAMBIA RIVER
641076	AC-04	F-113-46	ESCAMBIA R. AMERICAN CYANIMID CO	FLORIDA	ESCAMBIA RIVER

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

AMERICAN CYANIMID COMPANY FIELD STUDY

STATION	DATE	TIME	DATE	TIME	DEPTH	00058 FLOW RATE GPM	00435 T ACDITY CACO3 MG/L	00410 T ALK CACO3 MG/L	00310 BOD 5 DAY MG/L	00340 COD HI LEVEL MG/L	00680 T ORG C C MG/L	00665 PHOS-T P-WET MG/L	00535 RESIDUE VOL NFLT MG/L	00403 LAB PH SU
AC-01	720307	0800(C)	720308	0800		1956	0	22	53.0	548	180.0	0.07	53	8.8
AC-01	720308	0807(C)	720309	0800		2010	15	0	112.0K	452	150.0	0.08	48	4.1
AC-01	720309	0805(C)	720310	0805		1965	51	0	252.0	543	132.0	0.14	62	3.1
AC-01	720310	0810(C)	720311	0730		1854	0	30	155.0	508	132.0	0.12	44	9.2
AC-01	720311	0800(C)	720312	0805		1802	0	20	100.0K	520	124.0	0.17	47	8.6

STATION	DATE	TIME	DATE	TIME	DEPTH	00530 RESIDUE TOT NFLT MG/L	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00515 RESIDUE DISS-105 C MG/L	00520 RESIDUE VOL FLT MG/L	00630 NO2&NO3 N-TOTAL MG/L
AC-01	720307	0800(C)	720308	0800		71	1070	350	66.0	2.15	999	297	55.0
AC-01	720308	0807(C)	720309	0800		72	1050	371	50.5	10.00	978	323	45.0
AC-01	720309	0805(C)	720310	0805		93	1060	357	42.0	15.00	967	295	60.0
AC-01	720310	0810(C)	720311	0730		91	1060	386	49.5	1.75	969	342	75.0
AC-01	720311	0800(C)	720312	0805		84	1080	376	54.0	1.90	996	329	50.0

STATION	DATE	TIME	DATE	TIME	DEPTH	32730 PHENOLS UG/L	00550 OIL GRSE TOTAL MG/L	00730 THIOCYAN SCN MG/L	00720 CYANIDE CN MG/L	00010 WATER TEMP CENT	00400 PH SU	00059 FLOW RATE INST-GPM	00095 CNDUCTVY AT 25C MICROMHO
AC-01	720307	0800								42.5	7.6	2050	
AC-01	720307	1613				7	0.9	17.6	0.20	40.5	6.6	1900	
AC-01	720308	0800								41.5	6.7	2150	
AC-01	720309	0803				660	10.2	94.0	0.48	40.5	10.3		
AC-01	720309	0805										2200	
AC-01	720310	0805				7	4.4	16.3	0.09	41.5	8.6	1850	
AC-01	720311	0745				6	3.8	18.7	0.19	41.5	4.7	1800	
AC-01	720312	0805				14	0.9	24.0	0.36	43.0	6.4	1750	

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

AMERICAN CYANIMID COMPANY FIELD STUDY

STATION	DATE	TIME	DATE	TIME	DEPTH	00058 FLOW RATE GPM	00435 T ACDITY CACO3 MG/L	00410 T ALK CACO3 MG/L	00310 BOD 5 DAY MG/L	00340 COD HI LEVEL MG/L	00680 T ORG C C MG/L	00665 PHOS-T P-WET MG/L	00535 RESIDUE VOL NFLT MG/L	00403 LAB PH SU
AC-02	720307	0840(C)	720308	0840		1956	20	151	124.0	332	88.0	0.12	22	7.4
AC-02	720308	0845(C)	720309	0840		2010	15	133	127.0	310	88.0	0.15	6	7.4
AC-02	720309	0845(C)	720310	0840		1965	20	108	168.0	327	89.0	0.11	21	7.1
AC-02	720310	0840(C)	720311	0825		1854	17	135	134.0	322	83.0	0.09	17	7.2
AC-02	720311	0830(C)	720312	0835		1802	11	170	60.0K	305	92.0	0.21	13	7.6

STATION	DATE	TIME	DATE	TIME	DEPTH	00530 RESIDUE TOT NFLT MG/L	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00515 RESIDUE DISS-105 C MG/L	00520 RESIDUE VOL FLT MG/L	00630 NO2&NO3 N-TOTAL MG/L
AC-02	720307	0840(C)	720308	0840		22	922	191	64.5	15.00	900	169	15.0
AC-02	720308	0845(C)	720309	0840		8	921	193	51.5	15.00	913	187	25.0
AC-02	720309	0845(C)	720310	0840		33	923	206	55.5	20.00	890	185	40.0
AC-02	720310	0840(C)	720311	0825		27	860	165	45.7	20.00	833	148	35.0
AC-02	720311	0830(C)	720312	0835		23	894	137	55.0	15.00	871	124	10.0

STATION	DATE	TIME	DATE	TIME	DEPTH	32730 PHENOLS UG/L	00550 OIL GRSE TOTAL MG/L	00730 THIOCYAN SCN MG/L	00720 CYANIDE CN MG/L	00010 WATER TEMP CENT	00400 PH SU	00059 FLOW RATE INST-GPM	00095 CNDUCTVY AT 25C MICROMHO
AC-02	720307	0840								26.0	7.4		
AC-02	720307	1630				24		58.0	0.14	26.0	7.3		
AC-02	720308	0840								25.5	7.4		
AC-02	720309	0845				15	0.5K	51.0	0.06	24.5	7.3		
AC-02	720310	0840				14	0.5K	48.0	0.18	25.5	7.1		
AC-02	720311	0825				20	2.3	49.0	0.42	26.0	7.6		
AC-02	720312	0835				33	0.5K	51.0	0.29	26.0	7.6		

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

AMERICAN CYANIMID COMPANY FIELD STUDY

STATION	DATE	TIME	DATE	TIME	DEPTH	00058 FLOW RATE GPM	00435 T ACDITY CACO3 MG/L	00410 T ALK CACO3 MG/L	00310 BOD 5 DAY MG/L	00340 COD HI LEVEL MG/L	00680 T ORG C C MG/L	00665 PHOS-T P-WET MG/L	00535 RESIDUE VOL NFLT MG/L	00403 LAB PH SU
AC-03	720307	0825(C)	720308	0825		1845	22	132	131.0	374	88.0	0.12	24	7.6
AC-03	720308	0830(C)	720309	0815		1850	6	119	127.0	349	86.0	0.08	9	7.4
AC-03	720309	0825(C)	720310	0820		1850	16	101	181.0	341	91.0	0.18	16	7.2
AC-03	720310	0825(C)	720311	0810		1825	10	109	141.0	351	104.0	0.10	21	7.5
AC-03	720311	0820(C)	720312	0820		1820	10	106	60.0K	360	100.0	0.20	16	7.4

STATION	DATE	TIME	DATE	TIME	DEPTH	00530 RESIDUE TOT NFLT MG/L	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00515 RESIDUE DISS-105 C MG/L	00520 RESIDUE VOL FLT MG/L	00630 NO2&NO3 N-TOTAL MG/L
AC-03	720307	0825(C)	720308	0825		26	941	196	63.0	15.00	915	172	35.0
AC-03	720308	0830(C)	720309	0815		9	970	213	53.0	15.00	861	204	30.0
AC-03	720309	0825(C)	720310	0820		28	923	206	55.0	20.00	895	190	40.0
AC-03	720310	0825(C)	720311	0810		29	910	180	49.0	15.00	881	159	45.0
AC-03	720311	0820(C)	720312	0820		21	963	211	56.0	10.00	942	195	30.0

STATION	DATE	TIME	DATE	TIME	DEPTH	32730 PHENOLS UG/L	00550 OIL GRSE TOTAL MG/L	00730 THIOCYAN SCN MG/L	00720 CYANIDE CN MG/L	00010 WATER TEMP CENT	00400 PH SU	00059 FLOW RATE INST-GPM	00095 CNDUCTVY AT 25C MICROMHO
AC-03	720307	0825								27.0	6.0		
AC-03	720307	1617				18	0.5K	57.0	0.21	29.5	7.0		
AC-03	720308	0825								27.5	7.5		
AC-03	720309	0825				19	0.5K	55.0	0.26	24.5	7.3		
AC-03	720310	0820				15	0.8	47.0	0.09	26.5	7.3		
AC-03	720311	0810				14	2.3	53.0	0.14	27.0	8.8		
AC-03	720312	0820				16	0.5K	53.0	0.25	28.0	8.6	1800	

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

AMERICAN CYANIMID COMPANY FIELD STUDY

STATION	DATE	TIME	DATE	TIME	DEPTH	00058 FLOW RATE GPM	00435 T ACDITY CACO3 MG/L	00410 T ALK CACO3 MG/L	00310 BOD 5 DAY MG/L	00340 COD HI LEVEL MG/L	T ORG C C MG/L	00665 PHOS-T P-WET MG/L	00535 RESIDUE VOL NFLT MG/L	00403 LAB PH SU
AC-04	720309	1530								8	1.0K	0.01K	5K	
AC-04	720310	1300					6	1		2	1.0K	0.01K	5K	5.0

STATION	DATE	TIME	DATE	TIME	DEPTH	00530 RESIDUE TOT NFLT MG/L	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00515 RESIDUE DISS-105 C MG/L	00520 RESIDUE VOL FLT MG/L	00630 NO2&NO3 N-TOTAL MG/L
AC-04	720309	1530				5K	37	16	0.6	0.15	37	16	0.3
AC-04	720310	1300				5K	28	8	0.5	0.15	28	8	0.3

STATION	DATE	TIME	DATE	TIME	DEPTH	32730 PHENOLS UG/L	00550 OIL GRSE TOTAL MG/L	00730 THIOCYAN SCN MG/L	00720 CYANIDE CN MG/L	00010 WATER TEMP CENT	00400 PH SU	00059 FLOW RATE INST-GPM	00095 CNDUCTVY AT 25C MICROMHO
AC-04	720309	1530						1.0K					

ELEMENTS IN LAGOON EFFLUENT
AMERICAN CYANAMID COMPANY
SANTA ROSA PLANT
MARCH 6-12, 1972

Elements detected in lagoon effluents (Stations AC-2 and AC-3) by spark source-mass spectrometer scan:

Lead	Strontium	Calcium	Aluminum
Barium	Bromine	Potassium	Magnesium
Antimony	Zinc	Chlorine	Sodium
Tin	Iron	Sulfur	Boron
Silver	Manganese	Phosphorus	
Molybdenum	Chromium	Silicon	

Metal concentrations determined by atomic asorption methods:

Station AC-2		Station AC-3		Station AC-4	
Parameter	Conc (µg/l)	Parameter	Conc (µg/l)	Parameter	Conc (µg/l)
Chromium	130	Chromium	90	Chromium	<50
Cobalt	<100	Cobalt	<100	Cobalt	<100
Copper	<50	Copper	<50	Copper	<50
Manganese	<50	Manganese	<50	Manganese	<50
Titanium	<500	Titanium	<500	Titanium	<500
Vanadium	<500	Vanadium	<500	Vanadium	<500
Zinc	10	Zinc	<10	Zinc	<10

APPENDIX D

CORRESPONDENCE

CYANAMID

AMERICAN CYANAMID COMPANY · FIBERS DIVISION

SANTA ROSA PLANT

MILTON, FLORIDA 32570

AREA CODE 904 994-5311

April 12, 1972

Copy to: Mr. Billy H. Adams,
Chief Engineer

Mr. Charles Sweatt, Sanitary Engineer
U. S. Environmental Protection Agency
Water Quality Office, Southeast Water Laboratory
Athens, Georgia 30601

Reference: 1. Letter 2/25/72, Mr. G. J. Kenngott to Mr. John C. White
2. Letter 3/9/72, Mr. G. J. Kenngott to Mr. Charles Sweatt

Dear Mr. Sweatt,

This is to confirm our telephone conversation of Tuesday, April 11, 1972 concerning in-plant carbon and nitrogen measurements made during your recent survey of the Santa Rosa Plant, March 7th to March 12th, and to transmit this data to you.

The attachment is a summary of flow and carbonaceous and nitrogenous waste loadings from the Fibers, Reactor and Recovery Areas and the lagoon influent. These areas accounted for an average of about 77% of the total carbon, about 101% of total nitrogen and about 68% of total flow, when compared to the same parameters measured on lagoon influent.

Below the above summary is the Carpet Plant and Utilities Areas contribution to carbonaceous and nitrogenous waste for one 24-hour period. This data and prior characterization studies have indicated these two wastewaters as insignificant sources of carbonaceous and nitrogenous wastes.

As you plan to be in our area on April 20, 1972, we would suggest that we meet at 1300-1330 hours to review the attached and the lagoon data. We would appreciate an advance copy of your analytical results on the lagoon so that we may be prepared to comment and reduce time requirements for the meeting. Review of these data should satisfy requirements of objectives 1 and 2 enumerated in reference 1. We would also like to discuss objective 3 (ref. 1) at this meeting, since there is limited time prior to your report to the Conferees on May 1, 1972.

We hope the attached data and the meeting time and subject will meet with your approval.

Sincerely yours,

K. N. Sharitz

K. N. Sharitz, Supervisor
Environmental Controls

KNS:ss
ATT: 1

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CARBON AND NITROGEN SUMMARY
EPA STUDY PERIOD 3/7-3/11/72

Attachment: #1

PARAMETER	DATE	FIBERS AREA CONC. mg/L	FIBERS AREA #/DAY	REACTOR AREA CONC. mg/L	REACTOR AREA #/DAY	RECOVERY AREA CONC. mg/L	RECOVERY AREA #/DAY	TOTAL #/DAY	LAGOON INFLUENT CONC. mg/L	LAGOON INFLUENT #/DAY
Total Carbon	3/7								113	5,127
	3/8	21	345	760	2,883	41	430	3,658	105	4,849
	3/9	23	378	780	3,100	33	342	3,820	100	4,455
	3/10	19	305	790	3,130	28	257	3,692	105	4,634
	3/11	33	542	600	2,471	30	283	3,296	103	4,453
AVERAGE		24	393	733	2,896	33	328	3,617	105	4,704
Tot.Nitrogen	3/7								74.1	3,362
	3/8	13.5	222	521.3	1,978	50.7	532	2,732	60.3	2,785
	3/9	15.0	247	558.5	2,219	37.0	383	2,849	56.6	2,522
	3/10	12.0	193	735.2	2,913	31.1	286	3,392	63.2	2,789
	3/11	24.1	396	433.3	1,785	39.1	369	2,550	65.7	2,841
AVERAGE		16.2	265	562.1	2,224	39.5	393	2,881	64.0	2,860
Flow MGD	3/7	1.971(1)		0.455(2)		1.258(3)			5.440	
	3/8	1.971		0.455		1.258			5.537	
	3/9	1.971		0.476		1.241			5.342	
	3/10	1.925		0.475		1.102			5.292	
	3/11	1.971		0.494		1.133			5.184	
AVERAGE		1.9595		0.475		1.184			5.359	

(1) Based on prior characterization June 1971.
(2) Flow measured on input side of process 100%.
(3) Flow measured on input side 75%, remainder based on June 1971 characterization.

PARAMETER	DATE	CARPET PLANT CONC.	CARPET PLANT #/DAY	UTILITIES AREA CONC.	UTILITIES AREA #/DAY
Total Carbon	3/11/72	38	1.14	20	32
Total Nitrogen	3/11/72	2.9	0.09	12.3	20
Flow, MGD		0.00359(2)		0.191(1)	

CYANAMID

AMERICAN CYANAMID COMPANY · FIBERS DIVISION

SANTA ROSA PLANT

MILTON, FLORIDA 32570

AREA CODE 904 994-5311

May 9, 1972

Mr. Billy H. Adams, Chief Engineer
Services Surveillance & Analysis Division
U. S. Environmental Protection Agency
Water Quality Office, Southeast Water Laboratory
Athens, Georgia 30601

Dear Mr. Adams:

As requested in our meeting of April 20, 1972, we are providing the base load information (Attachment I) and a summary of source controls and process improvements completed since January 1970, or in progress, to reduce the base load to Santa Rosa's wastewater treatment facilities (Attachment II).

"Base load" is defined as contaminants contributed by plant operations to our wastewater treatment system.

Column 1 - is the base load of the lagoon influent in January 1970.

Column 2 - is the base load of lagoon influent as measured in 1970 but corrected for anticipated plant capacity in 1975.

(We believe the 1975 base load is pertinent to the present consideration because we intend to design facilities to handle that load. It has been Cyanamid's plan to reach the 1975 level of production as evidenced as far back as 1966 when the second lagoon was designed and installed with a capacity to handle the 1975 production level. In addition, virtually all facilities needed to support the 1975 level of production have been installed at this plant.)

Column 3 - is actual influent load March 7 thru 12, 1972.

Column 4 - is the data in Column 3 recalculated to the same production rate as shown in Column 1.

Column 5 - shows effect of process improvements and source controls completed since 1970, i.e., Column 1 less Column 4.

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The Santa Rosa Plant was designed and operates to recycle costly raw materials such as acrylonitrile and sodium thiocyanate. Prior to 1970 numerous in-plant improvements were made to improve the recovery of these materials; for example, recovery of sodium thiocyanate improved so that loss per pound of polymer decreased by about 75%.

Sincerely,

G. J. Kenngott
Manager
Santa Rosa Plant

GJK:rg

Copy to: Mr. Charles Sweatt, Sanitary Engineer
Environmental Protection Agency
Water Quality Office, Southeast Water Laboratory
Athens, Georgia 30601

Mr. K. N. Sharitz, Santa Rosa Plant

ATTACHMENT I

	COLUMN 1		COLUMN 2		COLUMN 3	COLUMN 4	COLUMN 5	
	LAGOON INFLUENT, 1/70 RATE: 264M LBS. PRODUCT FIBER/DAY		LAGOON INFLUENT, 1975 RATE: 416M LBS. PRODUCT FIBER/DAY		LAGOON INFLUENT, 3/7-12/72 RATE: 235M#/DAY	264M#/DAY	REDUCTION COLUMN 1 - COLUMN 4	
	AVERAGE (LBS/DAY)	MAXIMUM (LBS/DAY)	AVERAGE (LBS/DAY)	MAXIMUM (LBS/DAY)	ACTUAL (LBS/DAY)	CALCULATED	LBS/DAY	%
COD	65,520	111,825	103,000	175,000	23,446	26,377	39,143	59.7
BOD	Not Measured		-	-	8,146	9,164		
TOTAL CARBON	7,718	12,757	12,200	20,000	4,703	5,291	2,427	31.4
NH_3 - N	189	378	298	595	128	144		
TKN	2,898	6,804	4,560	10,650	2,249	2,530		
NO_3-NO_2 N	1,985	2,678	3,120	4,210	610	686		
TOTAL N	4,883	9,482	7,680	14,860	2,859	3,216	1,667	34.1

GJK:rg
5/9/72

REVISED 7/17/72

ATTACHMENT 11

AMERICAN CYANAMID COMPANY

SANTA ROSA PLANT

Source Controls and Process Improvements Since January, 1970(1)

		Plant Wastewater Parameter Reductions	
A.	Removal of AN contaminated water from chemical sewer.	COD TOC AN	22,632 #/day 1,569 #/day 1,089 #/day
B.	Increased efficiency of strippers to 99 + % AN removal.	AN	~ 700 #/day
C.	Removal and recovery of NaSCN from chemical sewer - a continuing project where we have contained production areas and/or process operations and the wastewaters are returned to solvent recovery rather than sewered.	NaSCN	~ 6,000 #/day
D.	Finish removal from chemical sewer	Total Carbon	~ 500 #/day
E.	Darco/Hyflo solids removal to be operational by September 1972. Solids previously sewered will be removed by filtration from the wastewaters prior to discharge to the sewer.	Susp. Solids	~ 70%
F.	Clean water separation and recycle scheduled for completion the fourth quarter 1972.	Flow	~ 20%
G.	A new process for producing polymer has been developed resulting in significantly less carbonaceous wastes. Process is scheduled for introduction during fourth quarter 1972.	Total Carbon	~3,000 #/day

Items A through D presently contributing to pollution abatement program.
Items E, F and G to be completed as indicated.

(1) There were no source controls installed prior to 1970. Process improvements were not evaluated for pollution paramcter response prior to 1970.

KNS:ss
4/28/72